



Materials Engineering Branch

TIP*



No. 105 Stress Relief and Conformal Coatings

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A primary mode of printed wiring board (PWB) failures is exhibited by fatigue cracks in solder joints and solder pad lifting, induced by thermal cycling. The ultimate cause is the induced stress associated with the mismatch of thermal expansion of the organic materials (the PWB, conformal coating, etc.) and the metals (solder, component leads, etc.) used in the system.

Workmanship standards for the fabrication of PWBs have always included steps to minimize these stresses. For example, stress relief built into component leads and minimal dwell time with soldering iron. It is just as important that additional treatments, such as conformal coating and staking, do not impart additional stresses via excessive thickness and bridging, thus nullifying the built-in component strain relief.

A variety of coating systems are available. The preferred materials for GSFC hardware are polyurethanes that have low glass transition temperatures. Experience in our Branch with polyurethanes indicates that a coating thickness of 0.003-0.005" (3-5 mils), gives a satisfactory coverage, requiring minimal touch-up of high points to properly prepared boards, while imparting minimal stress to the PWB and electronic assembly.

Staking with thixotropic materials should not be excessive but should be of a quantity and consistency sufficient to support the component without bridging built-in strain relief.

Since NASA 8739.1, "Workmanship Standards for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies," does not specify a coating thickness, a thickness requirement must be specified in the project documentation, for example, the engineering drawing or manufacturing process.